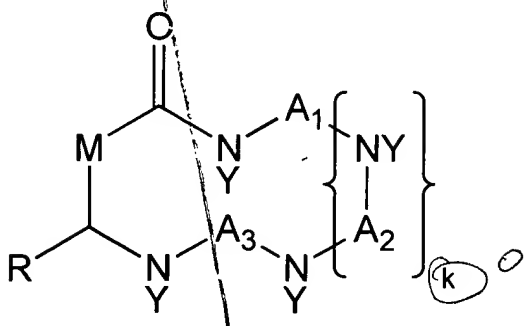
CLAIMS

1. A compound of the formula



wherein A_1, each A_2 (if present), and A_3 are independently selected from C_1-C_8 alkyl;

wherein each Y is independently selected from H or C_1-C_4 alkyl;

wherein M is selected from C_1-C_4 alkyl;

wherein k is 0, 2, or 3;

and wherein R is selected from C_1-C_{32} alkyl;

and all stereoisomers and salts thereof.

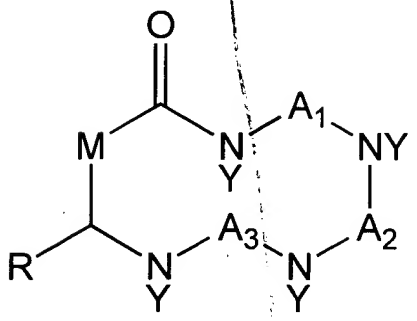
2. A compound according to claim 1, wherein each Y group is -H.

3. A compound according to claim 1, wherein each Y group is $-CH_3$.

4. A compound according to claim 1, wherein A_1, each A_2 (if present), and A_3 are independently selected from C_2-C_4 alkyl.

5. A compound according to claim 1, wherein M is $-CH_2-$.

6. A compound of the formula



wherein A_1 and A_3 are independently selected from C_1-C_8 alkyl;

wherein A_2 is independently selected from C_1-C_3 alkyl or C_5-C_8 alkyl;

wherein each Y is independently selected from H or C_1-C_4 alkyl;

wherein M is selected from C_1-C_4 alkyl;

and wherein R is selected from C_1-C_{32} alkyl;

and all stereoisomers and salts thereof.

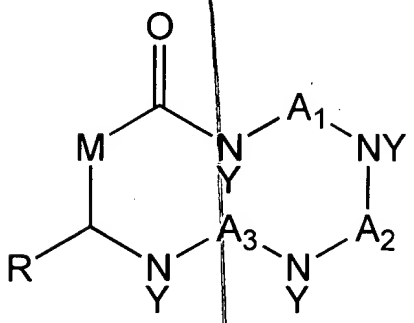
7. A compound according to claim 6, wherein each Y group is -H.

8. A compound according to claim 6, wherein each Y group is $-CH_3$.

9. A compound according to claim 6, wherein A_1 and A_3 are independently selected from C_2-C_4 alkyl, and A_2 is selected from the group consisting of C_2-C_3 alkyl and C_5 alkyl.

10. A compound according to claim 6, wherein M is $-CH_2-$.

11. A compound of the formula



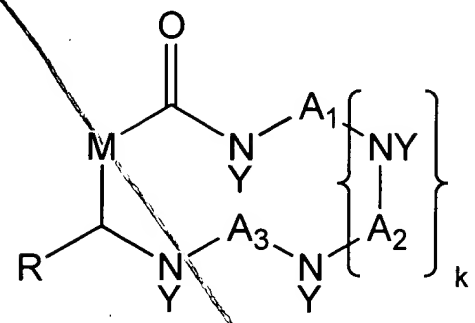
wherein A_1 and A_3 are independently selected from C_1-C_8 alkyl;
wherein A_2 is independently selected from C_1-C_8 alkyl;
wherein each Y is independently selected from H or C_2-C_4 alkyl;
wherein M is selected from C_1-C_4 alkyl;
and wherein R is selected from C_1-C_{32} alkyl;
and all stereoisomers and salts thereof.

12. A compound according to claim 11, wherein each Y group is -H.

13. A compound according to claim 11, wherein A_1 and A_3 are independently selected from C_2-C_4 alkyl, and A_2 is selected from the group consisting of C_2-C_5 alkyl.

14. A compound according to claim 11, wherein M is $-CH_2-$.

15. A method of synthesizing a compound of the formula



wherein A_1, each A_2 (if present), and A_3 are independently selected from C_1-C_8 alkyl;

wherein each Y is independently selected from H or C_1-C_4 alkyl;

wherein M is selected from C_1-C_4 alkyl;

wherein k is 0, 1, 2, or 3;

and wherein R is selected from C_1-C_{32} alkyl;

comprising the steps of:

reacting an ω-halo alkyl alkanoate with an aldehyde or ketone-containing compound to give an alkene-containing alkanoate compound;

reacting the alkene-containing alkanoate compound with a compound containing two primary amino groups and optionally containing secondary amino groups to effect addition of one of the amino groups across the double bond;

cyclizing the other amino group with the alkanoate group to form an amide bond; and

optionally alkylating the secondary amino groups if present.

16. The method of claim 15, wherein the ω-halo alkyl alkanoate is ethyl bromoacetate.

17. The method of claim 16, wherein the aldehyde or ketone-containing compound is an aldehyde-containing compound.

18. The method of claim 16, wherein the step of reacting an ω-halo alkyl alkanoate with an aldehyde or ketone-containing compound to give an alkene-containing alkanoate compound is performed by reacting the ω-halo alkyl alkanoate with triphenylphosphine.

Sub A2

19. The method of claim 16, wherein the compound containing two primary amino groups is selected from the group consisting of $H_2N\text{-}A_1\text{-}(NH\text{-}A_2)_k\text{-}NH\text{-}A_3\text{-}NH_2$

wherein A_1, each A_2 (if present), and A_3 are independently selected from C_1-C_8 alkyl and k is 0, 1, 2, or 3.

20. The method of claim 19, wherein the compound containing two primary amino groups is selected from the group consisting of spermine, spermidine, and putrescine.

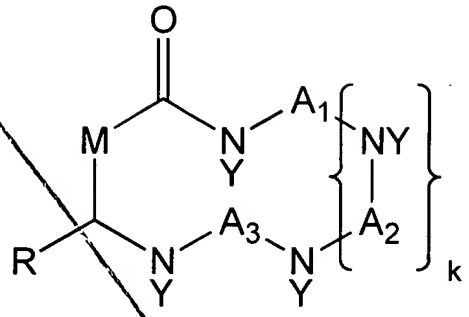
21. The method of claim 16, wherein the step of cyclizing the other amino group with the alkyl alkanoate group to form an amide bond is performed by reacting the compound with antimony (III) ethoxide.

22. The method of claim 16, wherein the step of optionally alkylating any secondary amino groups if present is performed by reacting the compound first with an aliphatic aldehyde to result in a Schiff base, then reducing the Schiff base, resulting in alkylation of the secondary amino groups.

23. The method of claim 22, wherein the step of reducing the Schiff base is performed by using the reagent $NaCNBH_3$.

Sub A3

24. A method of synthesizing a compound of the formula



wherein A_1 is C_3 alkyl, and each A_2 (if present) and A_3 are independently selected from C_1-C_8 alkyl;

wherein each Y is independently selected from H or C_1-C_4 alkyl;

wherein M is selected from C_1-C_4 alkyl;

wherein k is 0, 1, 2, or 3;

and wherein R is selected from C_1-C_{32} alkyl;

comprising the steps of:

condensing a compound comprising a primary amino group and a hexahydropyrimidine moiety with an α,β-unsaturated ester compound such that the primary amino group adds at the β-position of the unsaturated ester compound, whereby the primary amino group is converted to a secondary amino group;

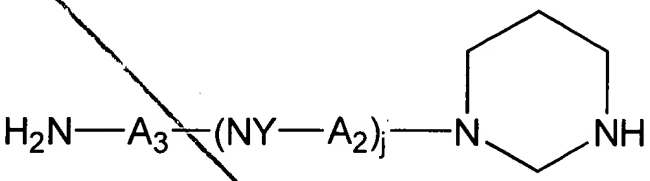
cleaving the methylene bridge of the hexahydropyrimidine moiety to generate a secondary amino group and a newly-generated primary amino group; and

condensing the newly-generated primary amino group with the ester group to form an amide group.

25. The method of claim 24, wherein the α,β-unsaturated ester is of the formula

(C_1-C_8 alkyl)-O-C(=O)-CH=CH-(C_1-C_{32} alkyl).

26. The method of claim 24, wherein the compound comprising a primary amino group and a hexahydropyrimidine moiety is of the formula



wherein each A_2 (if present) and A_3 are independently selected from C_1-C_8 alkyl;

wherein each Y is independently selected from H or C_1-C_4 alkyl; and

wherein j is 0, 1, 2, or 3.

27. The method of claim 26, wherein j is 0.

28. The method of 27, wherein A_3 is C_4 alkyl.

29. The method of 24, wherein the step of cleaving the methylene bridge of the hexahydropyrimidine moiety is performed with anhydrous HCl in an alcoholic solvent.

30. The method of 24, wherein the step of condensing the newly-generated primary amino group with the ester group to form an amide group is performed with the reagent $B(N(CH_3)_2)_3$.

31. A method of treating cancer or a disease characterized by uncontrolled cell proliferation in an individual in need of such treatment,

comprising the step of administering one or more compounds of claim 1.

32. A method of treating cancer or a disease characterized by uncontrolled cell proliferation in an individual in need of such treatment,

comprising the step of administering one or more compounds of claim 6.

33. A method of treating cancer or a disease characterized by uncontrolled cell proliferation in an individual in need of such treatment,

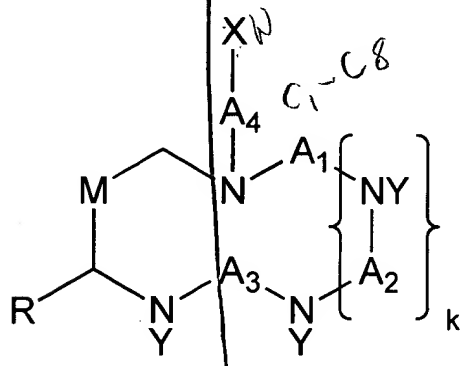
comprising the step of administering one or more compounds of claim 11.

34. A method of depleting ATP in a cancerous cell, comprising the step of administering one or more compounds of claim 1 to the cell.

35. A method of depleting ATP in a cancerous cell, comprising the step of administering one or more compounds of claim 6 to the cell.

36. A method of depleting ATP in a cancerous cell, comprising the step of administering one or more compounds of claim 11 to the cell.

37. A compound of the formula



wherein A_1, each A_2 (if present), and A_3 are independently selected from C_1-C_8 alkyl;

wherein A_4 is selected from C_1-C_8 alkyl or a nonentity;

X is selected from -H, -Z, -CN, $-NH_2$, $-C(=O)-C_1-C_8$ alkyl, or -NHZ, with the proviso that when A_4 is a nonentity, X is -H, $-C(=O)-C_1-C_8$ alkyl, or -Z;

Z is selected from the group consisting of an amino protecting group, an amino capping group, an amino acid, and a peptide;

wherein each Y is independently selected from H or C_1-C_4 alkyl;

wherein M is selected from C_1-C_4 alkyl;

wherein k is 0, 1, 2, or 3;

and wherein R is selected from C_1-C_{32} alkyl;

and all stereoisomers and salts thereof.

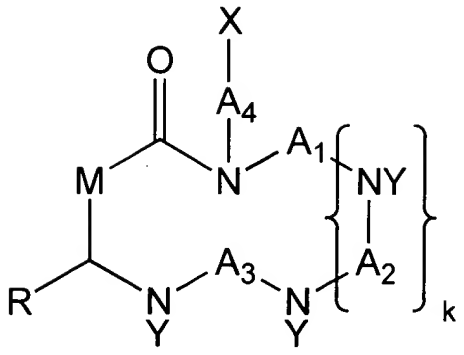
38. The compound of claim 37, wherein A_4 is a nonentity, X is -Z, -Z is -H, and each Y is $-CH_3$.

39. The compound of claim 38, wherein M is $-CH_2-$, k is 1, A_1 and A_3 are $-CH_2CH_2CH_2-$, and the single A_2 group is $-CH_2CH_2CH_2CH_2-$.

40. The compound of claim 39, wherein R is $-C_{13}H_{27}$.

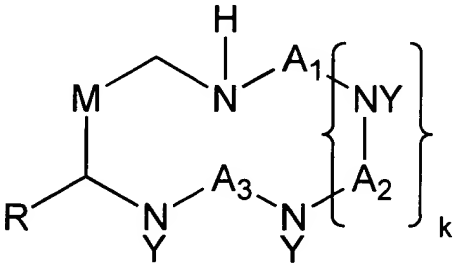
41. The compound of claim 37, wherein A_4 is C_1-C_8 alkyl, X is -NHZ, and and Z is selected from one of the 20 genetically encoded amino acids, a peptide of the formula acetyl-SKLQL-, a peptide of the formula acetyl-SKLQ-β-alanine-, or a peptide of the formula acetyl-SKLQ-.

42. A method of synthesizing a compound of claim 37, wherein A_4 is a nonentity and X is -H, comprising reducing the carbonyl of the amide group of a compound of the formula



wherein A_4 is a nonentity and X is -H.

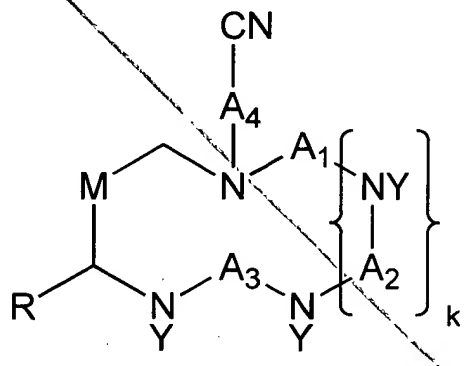
43. A method of synthesizing a compound of claim 37, wherein A_4 is C_2 alkyl, each Y is selected from C_1-C_4 alkyl, and X is -CN, comprising reacting a compound of the formula



wherein each Y is selected from C_1-C_4 alkyl,

with a compound of the formula H_2C=CH-CN.

44. A method of synthesizing a compound of claim 37, wherein A_4 is C_3 alkyl and X is $-NH_2$, comprising reducing the nitrile group of a compound of the formula



where A_4 is selected from C_1-C_7 alkyl,

to an amino group.